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This is to declare that in the Netherlands on October 27, 2003 under No. PCT/NL03/00730,

in the name of:

Hermannus Gerhardus Maria SILDERHUIS

in Enschede, the Netherlands

an international patent application was filed for:

"Air treatment device",

and that the documents attached hereto correspond with the originally filed documents.

Rijswijk, November 9, 2004

In the name of the president of the Netherlands Industrial Property Office

Mrs. D.L.M. Brouwer

AIR TREATMENT DEVICE

The present invention relates to an air treatment device comprising a fan, various filters, and a UV (Ultra Violet radiation) air treatment chamber.

In bounded spaces, such as rooms, in housed, buildings or other human or animal living environments, numerous pollutants such as dust and micro organisms like viruses, bacteria and fungae are present. These pollutants endanger the health of the human beings or animals living in these bounded spaces.

The present invention seeks to provide an air treatment device for improving the air quality in bounded spaces by reducing the particle content of the air, and killing the micro organisms in the air.

The air treatment device according to the present invention can be used in medical, residential, commercial, industrial and military and animal growing applications, either as a stand-alone unit, or as part of a further air conditioning system.

Aspects, advantages and features of the device according to the invention are explained in more detail by reference to the accompanying drawings illustrating exemplary embodiments, in which:

Fig. 1 schematically shows the structure of an air treatment device according to the present invention; and

Fig. 2 shows a perspective, partially cut-away view of an air treatment device according to an embodiment of the present invention.

In the different Figures, like reference numerals indicate like components or components having the same function.

Fig. 1 schematically illustrates the arrangement of various components in an air treatment device, which is generally indicated with reference numeral 1.

The air treatment device 1 comprises an elongated tube-like enclosure 2, having a cross-section which is generally circular or oval shaped, or has any other suitable cross-sectional shape, such as a rectangular or multiangular shape. The shape or the area of the cross-section of the enclosure 2 may vary along its length. In a preferred embodiment, the cross-section is circular, is constant along

the length of the enclosure 2, and has a diameter of about 0.2 - 0.3 metres.

The enclosure has an air inlet 4 at a first end thereof, and an air outlet 6 a second end thereof. Air generally is intended to flow through the enclosure 2 from the air inlet 4 to the air outlet 6. In one embodiment, a longitudinal axis of the enclosure 2 may be directed upright or generally vertically, with the air inlet 4 located at the lower end of the enclosure 2, and the air outlet 6 located at the upper end of the enclosure 2. However, in principle any orientation of the air treatment device may be selected.

From the air inlet 4 to the air outlet 6, air flowing through the enclosure 2 follows a path through or along various components, such as a dust filter 10, a HEPA filter 12, a carbon filter 14, a fan 16, an ionizer 18, and a UV treatment chamber 20 containing at least one UVC radiation source 22, in order to ensure the capture of particles and/or the termination of all viruses, bacteria and other harmful micro organisms in the air treatment device. Although the dust filter 10, the HEPA filter 12, and the carbon filter 14 are shown in Fig. 1 to be free from the enclosure 2, in a practical embodiment they extend to an inner wall (indicated with dashed lines) of the enclosure 2 to ensure that all air flowing through the enclusure 2 passes through each of these filters.

The dust filter 10 is situated downstream relative to the air inlet 4 to capture dust particles in the air having relatively large dimensions. The dust filter 10, being the first filter in the air treatment device 1, is also referred to as a prefilter. Preferably, the dust filter 10 is exchangeable and/or washable.

The HEPA (High Efficiency Particulate Air) filter 12, preferably manufactured from microfiberglass, is situated downstream relative to the dust filter 10, to capture small particles with sizes of about 0.1 to 0.3 microns and higher. The HEPA filter 12 may remove as much as 99.97% of airborne pollutants, and will further capture at least part of the total amount of viruses, bacteria, and fungae present in the air. A relatively small UVC (Ultra Violet rays type C) radiation source 11 situated in the vicinity of the HEPA filter 12 will kill the viruses, bacteria, and fungae captured in the HEPA filter 12 in the course of time. Preferably, the HEPA filter 12 is exchangeable. Also

preferably, the UVC radiation source 11 emits radiation at about 253 nanometres or any other suitable wavelength, and at an operating temperature of 40°C or any other suitable operating temperature. The UVC radiation source 11 is preferably placed at the side of the HEPA filter 12 facing the air inlet 4 of the enclosure 2.

The carbon filter 14 is situated downstream relative to the HEPA filter 12, and comprises electrodes (not shown) with an adjustable potential, to capture liquids (in particular water) and gases by polarization. Thus, the humidity of the air passing the carbon filter 14 may be controlled by controlling the potential of the electrodes of the carbon filter 14. By controlling the humidity of the air, the amount of water adhering to viruses and bacteria may be controlled with a view to controlling the effectiveness of the air treatment in the UV treatment chamber 20. A humidity sensor 13 located downstream relative to the carbon filter, preferably located in the UV treatment chamber 20, provides humidity data which are processed in a processing device 15 coupled to the humidity sensor 13. The processing device 15 is coupled to the electrodes of the carbon filter 14, and controls the potential of the electrodes in a predetermined manner such as to achieve a predetermined humidity of about 40-50% in the UV treatment chamber 20, irrespective of the humidity of the air entering the air inlet 4 of the air treatment device 1. Gases are also captured in the carbon filter 14, thus reducing any smells present in the air flowing through the air treatment device 1.

The fan 16 is situated downstream relative to the carbon filter 14 to generate high air flows in the air treatment device 1. A temperature sensor 17 is located in the UV treatment chamber 20, and coupled to a processing device (which may or may not be the same as the processing device 15 described above). The processing device is coupled to a motor of the fan 16, and controls the motor speed (and thus the flow rate of the air in the air treatment device 1) for achieving a predetermined temperature in the UV treatment chamber 20. This temperature depends on the amount of cooling of the at least one UVC radiation source 22 in the UV treatment chamber 20 by the air flowing by the at least one UVC radiation source 22.

In a practical embodiment, typically the air should flow along the at least one UVC radiation source 22 with a speed of about 1.5

metres/second to reach a steady state temperature in the UV treatment chamber 20 of about 40°C. Such a temperature will effect an optimum sterilization of the air in the UV treatment chamber, which can be achieved irrespective of the air temperature of the air entering the air treatment device at the air inlet 4, by controlling the motor speed of the fan 16. Depending on the configuration of the air treatment device 1, air flow delivery rates of 76 cubic metres per hour up to 380 cubic metres per hour (hyper dynamic flows) are possible, which would lead to an average room with a floor area of 4 x 8 metres having its entire volume treated in the air treatment device 1 several times per hour.

By placing the fan 16 downstream relative to the dust filter 10, the HEPA filter 12, and the carbon filter 14, the fan 16 can be kept clean.

The ionizer 18 is located downstream relative to the fan 16, and returns the ionization of the air to natural, human-friendly values.

The UV treatment chamber 20 contains the at least one UVC radiation source 22, preferably emitting UVC radiation at about 253 nanometres or any other suitable wavelength, and preferably being driven at 100% power output, when operating at 40°C. The at least one UVC radiation source 22 has an integrated temperature sensor 24 protecting the at least one UVC radiation source 22 from undercooling or overheating by adapting the power output thereof accordingly. The walls of the UV treatment chamber 20 are manufactured to provide a maximum reflection of UVC radiation. For this purpose, preferably aluminium has been sputtered on the walls of the UV treatment chamber. Accordingly, direct and up to 7 times reflected UVC radiation may increase the sterilizing efficiency of the UV treatment chamber 20 by 300%. The at least one UVC radiation source 22 is constructed such, that no ozone is created by its operation.

The air outlet 6 is constructed such that no UVC radiation may escape from the air treatment device 1. A special radiation absorbing paint is applied to the walls of the air outlet 6, and a maze-like structure of the air outlet 6 prevents any radiation from leaving the device.

The signals generated by the temperature sensors 17 and 24, and the humidity sensor 13 are evaluated in respective processing devices

coupled thereto, and the processing devices are adapted to turn off the air treatment device 1 if an potentially abnormal situation is detected, or if a situation arises in which a condition for replacement of a component of the air treatment device 1 is met. Examples of such situations are: stopping of the fan 16, overheating or undercooling of components, in particular the at least one UVC radiation source 22, exchange period of filter reached, etc.

Fig. 2 shows an enclosure 2 with a rectangular cross-section, which enclosure 2 has been partially cut away to expose the components accommodated in the enclosure 2. A housing may enclose the enclosure 2.

With the air treatment device of the present invention, bounded spaces can be safely decontaminated, in particular by killing all viruses, bacteria, fungae an other potentially harmful micro organisms, and by removing dust and other particles.

CLAIMS

1. Air treatment device comprising a fan, various filters, and a UV air treatment chamber.

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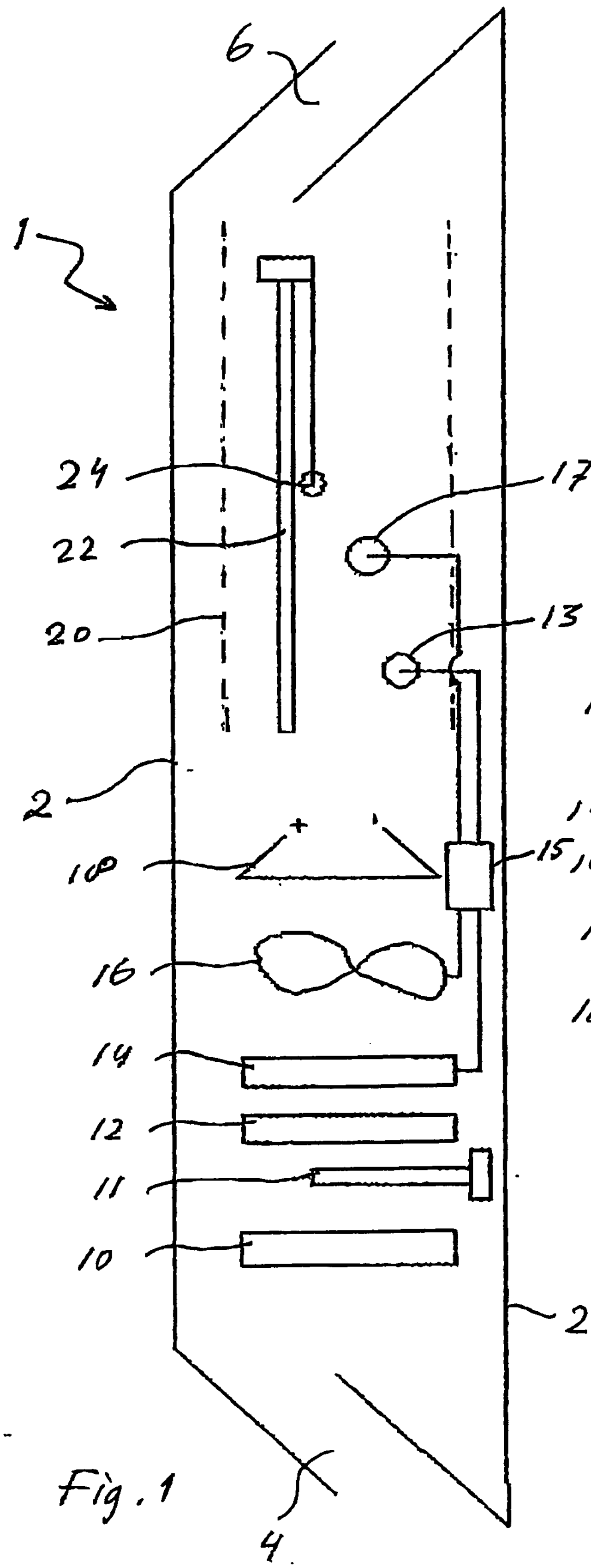

Fig. 1

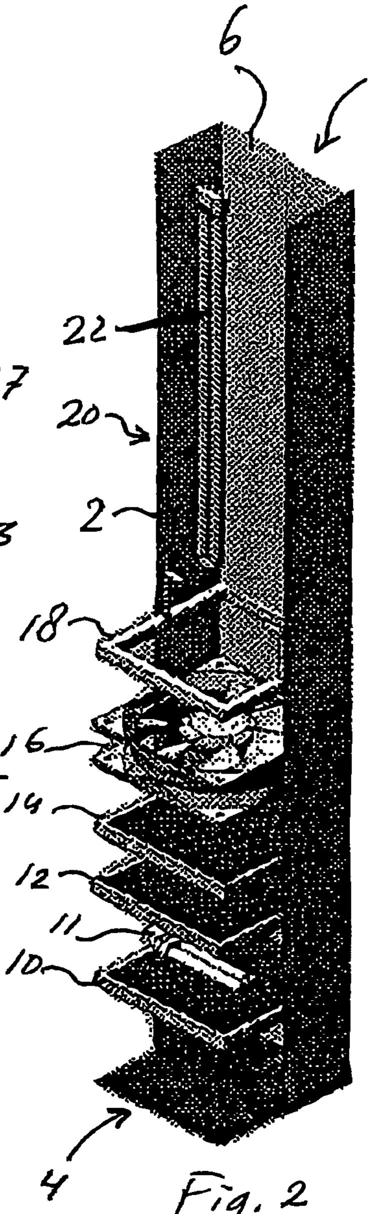

Fig. 2